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LISTings

Newsletter of the Long Island Sinclair / Timex Users' Group

15 YEARS AND STILL GOING STRONG!

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Please send all inquiries and submissions (including dues) to: L.I.S.T.
Mr. Robert Gilder
69 Jefferson Place
Massapequa, N. Y. 11758

COMING EVENTS: The next L.I.S.T. meeting will be Sunday, 10/19/97 at 2 P.M. at the home of Robert Malloy, 412 Pacific Street Massapequa Park, NY 11762
Tel: 516-541-6731

NEXT MEETING: OCTOBER 19, 1997

On e sample copy sent upon receipt of business size SASE. Copies provided on Exchange basis with other Bona fide user groups. We are always looking for articles, programs, reviews, etc to keep members informed and entertained. You maintain full credit and copyright.

QL CORNER

Quite a few QL users are placing their mother boards into desk top or tower cases. With the backplane device, the user can plug into the QL and use the power supply from the case. However, there may be a problem when you wish to install a device into the 64 pin connector at the front of the QL motherboard, such as a Trump Card, Gold Card or a SuperGold card. We will address this later! However, there is one item you must have, a keyboard interface. There are several different types of keyboard interfaces: ABC from Germany which plugs into the Eprom port; Keyboard 90 also from Germany; the Schoen Interface with a keyboard and the latest keyboard interface from the UK, Di-Ren QL Keyboard Interface. The SuperHermes interface also sports a keyboard interface.

Cable set-up

There are several items we have to address: Remove the QL motherboard from the original case. You will probably not use the Microdrives, so leave them on the QL case. You may want to solder two leads approximately 15 inches long onto the aft end of the Reset switch. A small push button switch can be positioned on the front of the case and soldered after the motherboard has been fixed to the case. I realize that you may have a Hermies/SuperHermies on your motherboard and you can reset your QL with ALT/CTRL/SHIFT/TAB, however, there are times that you may need a hard reset. This is up to the individual user.

Another double lead should be connected to the front two connectors where the LEDs are connected. Solder an LED on the free end. Use any color LED for this as it is used as a pilot light. If you want to retain the buzzer, you should make an extension cable from the connector on the QL Motherboard, solder the leads to the buzzer leads and position the buzzer at the front of the case.

Another short cable should be made for the keyboard interface. You will need a female 8-pin socket and a male 8-pin socket. The lines should be straight through, with the female socket attached to one of the back brackets.

Standoffs should be inserted into the new case. Make a template of the four mounting holes on the motherboard, then drill four holes into the bottom of the case. If you are using 6-32 bolts for standoffs; to be safe, place insulating washers between the QL motherboard and the case.

You will probably want the serial port connectors (ser1 & 2) and control connectors (ctrl1 & 2) mounted on the rear of the case. You will have to prepare four extension cables from the original output ports to the case slots. You can purchase 9-pin 'D' connectors and the brackets for the slots with two 9-pin cut-outs.

For Super GoldCard users who utilize the parallel port, they can purchase a bracket with a 25 pin 'D' connector cutout and prepare a length of 25 conductor ribbon cable from the Super GoldCard to the 25-pin connector using the proper gender connectors.

The power supply

If you don't have the backplane, you can find room for the original QL

power supply within the case. On both of my cased QLs I have positioned the QL power supply at the front left-hand area of the case and I have placed a small switch mode power supply in the same compartment for disk drive power.

The Interface

If you are using a large tower case, you can insert your Gold Card or SuperGold Card or perhaps a Trump Card into the front of the QL Motherboard. If you have a small tower case or a desk type case, you will need a flip-over interface for your front end device.

In 1986 I placed one of my QL motherboards into a desk top case and I decided to make a soft flip-over interface. I found some 64 conductor ribbon cable and crimped on a Euro male connector on one end. The other end I had to make the female connector from two 34 pin female connectors (female DB connectors) the same type we use on 3-1/2 inch disk drives. I filed one end of a connector until it was very close to the 33 & 34th pins. The other connector also had to be filed on the opposite end of the connector and then cut off the remainder. Then I epoxyed the connectors with 5 minute epoxy. The connectors were fastened to the ribbon cable. The female end of this interface was inserted into the QL motherboard socket. Foam rubber was placed on top of the motherboard and inserted a Trump Card into the other end of the interface. I switched on the QL and low and behold it initialized.

I really wasn't satisfied with the soft flip-over interface that I made! There had to be a better way. Approximately a year later I decided it was time to develop a simple hard interface. Using a proto board, with .1 spaced holes, I soldered in a double row of male headers (32-pins each) onto the top of the protoboard. Approximately 2 and 1/2 inches down from the male headers, a double row of female headers were soldered on the bottom of the protoboard. Thirty-two pieces of solid wires were prepared and were inserted between both headers and soldered on to the backside of the interface and the headers. Another thirty-two wires, slightly longer than the wires previously soldered onto the interface top and bottom header rows.

The female headers were purchased from MECI, 340 E. First St., Dayton, Ohio 45402; phone number: 1-800-344-6324. Item number: 240-1622, 2x32 Aromat AXB1640017; price 99 cents each. The male headers I chose for this project are: 240-1758, 2x17 Aromat AXL2349017; price 55 cents each. You will need two of these male headers and one will have to be cut to size.

I have located a source for male 64 pin EURO connectors at $1.79 each, Unicorn Electronics, 1142 State Route 18, Aliquippa, Pa., 15001; phone number: 412-495-1230.

There is another item that I decided to make. For the past three years I was the east coast Quanta librarian. Some of the membership were still using 5 1/4 inch floppy drives. I decided that I should make a cable with a rotary switch that drive one (flp1_), a 3 1/2 drive, would be able to become drive flp2_, and floppy drive two a 5 1/4 inch would become drive flp1_.

Next month I will try to make some sketches for the interface board and prepare a simple schematic diagram for the disk drive switching cable.

See you next month... *Bob Gilder*

Vector Graphics

4,294,967,296 vectors should take over a year to draw, even at 100 per second. However if you want to try — the ETI Graf-vec will do it.

THIS PROJECT takes us away from the familiar world of the TV display and shows us instead the other principal means of producing a picture. The ordinary TV set produces a picture by moving an electron beam backwards and forwards across a phosphor coated screen so that it traces a fixed number of paralle horizontal lines. The actual picture is produced by turning the beam on to display a bright dot at the right time and turning it off where no light is required. This method works very well for broadcast pictures, but is sometimes not so good for pictures generated electronically. For a home computer to generate a picture, it must generate a pattern of bits which determine when the electron beam in the display tube is to be on and off. Since the transitions can only occur at discrete time intervals, the picture produced does not always appear as smooth as we might wish. This effect is usually most noticeable on diagonal lines where there are marked contrast changes.

While we cannot pretend that this project will replace a TV type of display for home computer applications, it does provide an interesting alternative output device for graphics.

The method employed by the Graf-vec in producing a picture is to define the start and finish of a line and cause an electron beam to traverse the intervening space relatively slowly. Drawing many such lines in a short space of time allows us to build up a picture. The main disadvantage of this method is that if too many lines are drawn the whole display will appear to flicker. This can be reduced by the use of long persistence phosphors if available.

As described, the Graf-vec will draw lines between any two points on a 256x256 grid. The relatively simple circuitry used does not compensate for differing line lengths changing the brightness but still gives an interesting result.

The Circuit

The circuit consists of a power supply, digital input and control section, and two linear scan generators. The basic mode of operation requires a data source — probably your trusty home computer — to put two bytes of data into the device to represent the co-ordinates to which a vector is to be drawn (The starting point is assumed to be where you are now). The Graf-vec will draw the vector and then wait for the next set of data and indicate that it is ready. The digital input circuitry of the Graf-vec is designed so that one byte of the next vector can be input at any time as it is stored in a latch, but the second byte should only be put in after the status bit is detected as high as this will start the next scan.

When the second byte of a new vector is written in, the logic section generates a 400 uS enable pulse for the linear scan generators. This allows them to generate the linear voltage ramps which eventually move the spot around on the oscilloscope or other display device.

Once the 400 uS pulse has finished, the linear scan generators are set up ready for the next vector and the display enable or blank output will go low. If you have the facility available, this can be used to blank the display between vector scans or, by means of the internal latch accessible by writing to two further addresses, the display can be turned on and off to allow you to move position without drawing a line.

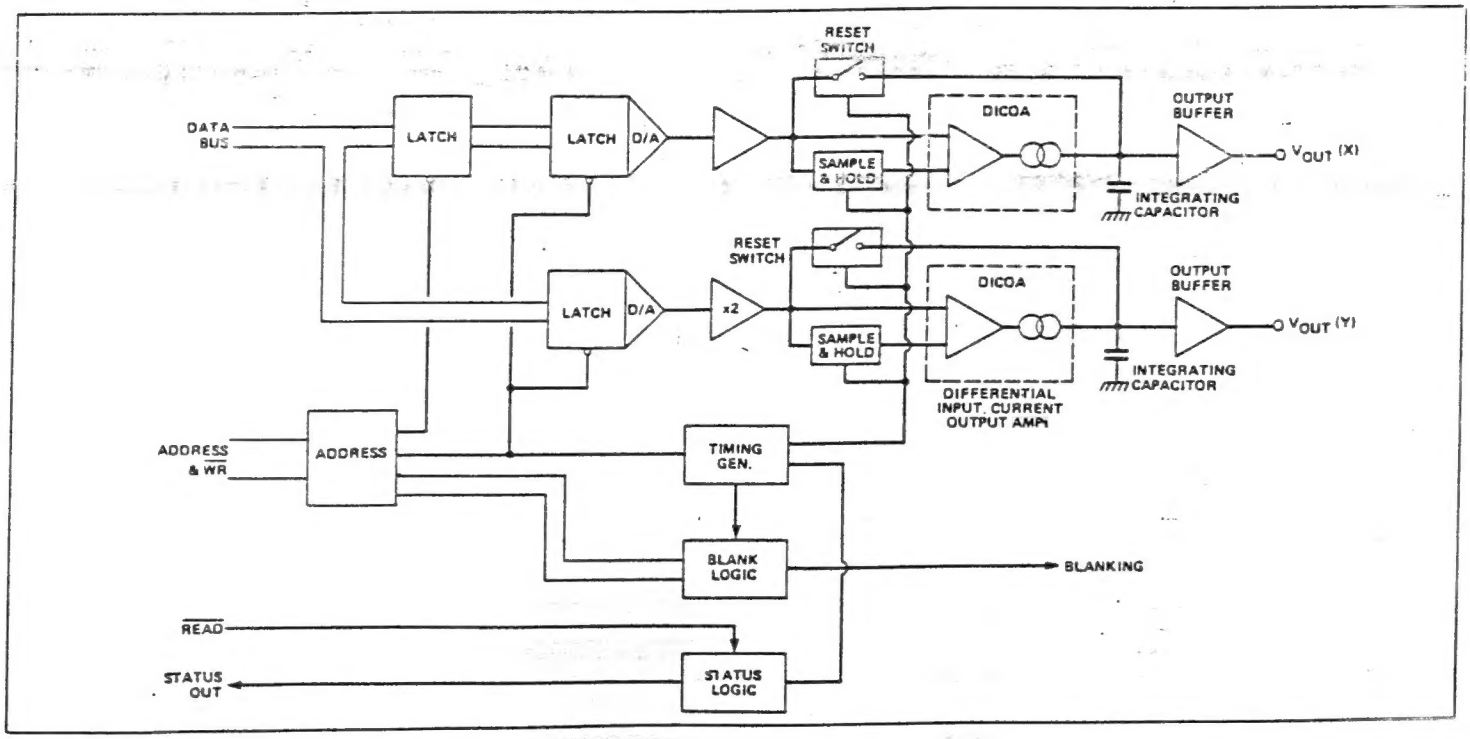


Fig. 1 Block diagram of the Graf-vec.

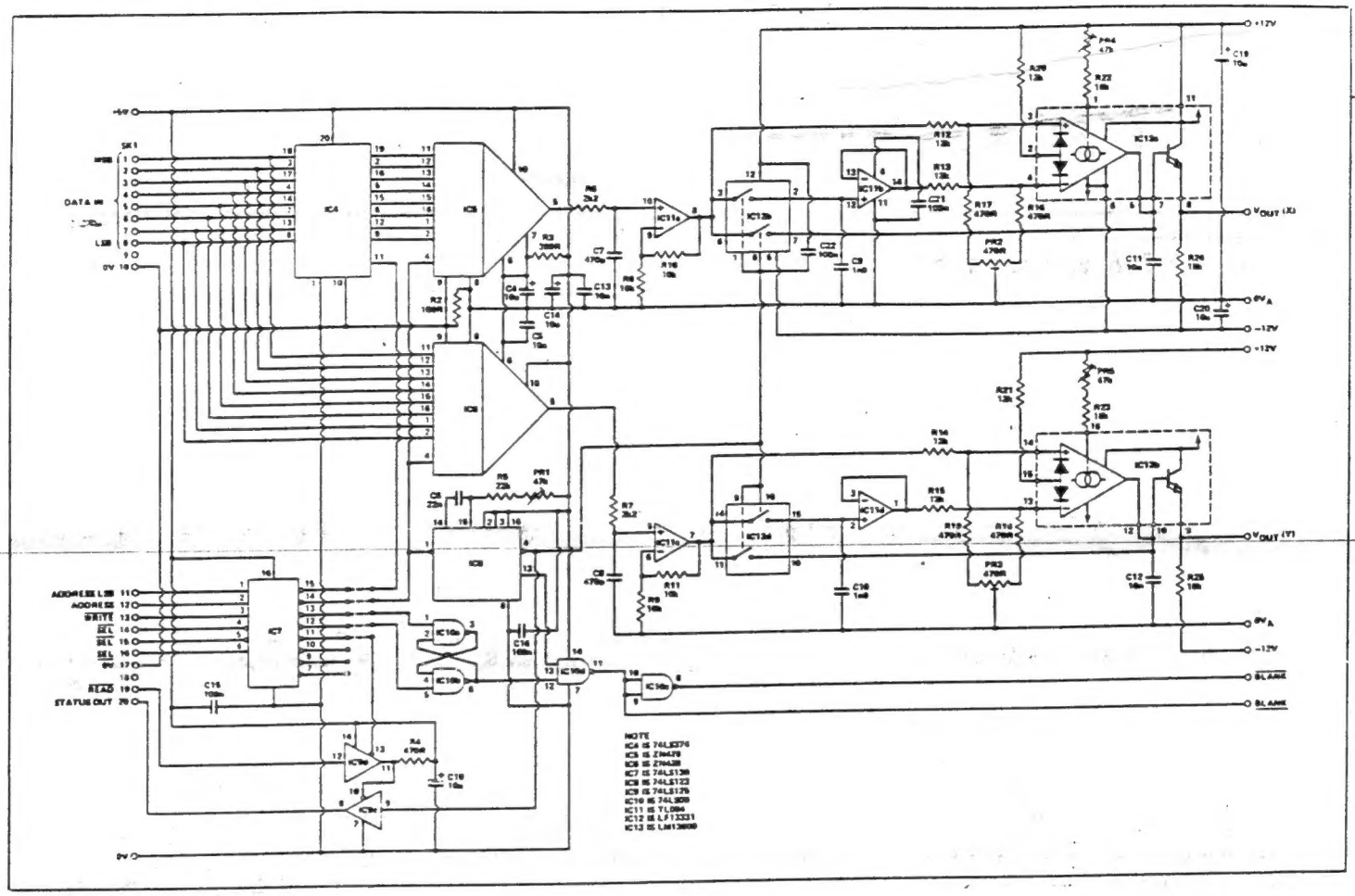


Fig. 2 Circuit diagram of the Graf-vec.

The Linear Scan Generator

This is the heart of the whole system and is basically an integrator. Before each scan starts, the output voltage and the voltage stored on a sample and hold circuit are clamped to the current output from the D to A circuits. When a scan starts, the sample and hold circuit changes to its hold function and the output is unclamped. Since the output is closely associated with the integrator capacitor it does not change immediately.

The D to A circuit now changes its output voltage to the new value and a current is generated which is proportional to the difference between the old and new input voltages. This current is used to charge the integrator capacitor and will do so at a constant rate. This gives a linear voltage ramp between the old output voltage and (if set up properly) the new one.

At the end of the scan pulse the sample and hold circuit and the output voltages are again clamped in readiness for the next scan. Note that while in the clamped state there is ideally no current flowing in the output circuit of the current generator as its input voltages are equal.

Semi-Solid Section

This is about the interface between the hardware described in this project so far and the software needed to make it do anything interesting. Fig. 6 shows in flow chart switch the actions needed to form the display. In order to prevent a lot of flicker, the routine scans all the points in the display many times each time it is called. The main cause of any residual flicker is the relatively slow response of the BASIC program which calls it. If this too were in machine code a very smooth display could result.

Table 1 shows how the flow chart is implemented in Z80 code while Table 2 (up to line 45) is the ZX81 basic program which is used to control it. Lines 50 onward are a simple program which allows hexa-decimal codes to be typed into the machine which are then held in the REM statement in line 10.

For initial entry of the machine code, alter line 50 to read:—

50FOR K=16514 TO 16543 Then you can run the program from line 50 and input the program code. Changing line 50 back again will let you type in the data for the picture. The format for typing hex numbers in is two characters 0 to 9, A to F followed by newline. Wrong characters or wrong number of characters will require re-entry of the correct ones. To abort this entry mode type a single space and newline. When first entered, line 10 can be REM with at least 64 characters after it.

While the development work for the project was done on a Z80 system, there is no reason why any other processor could not used. The only differences would be in the actual interface hardware and the machine code realization of our flow chart.

There are 8 data lines, 7 control lines and one status output to the project. Normally the data lines will be connected to the controller's data bus. The status output line is from a three state buffer and can be connected to the data bus (we used bit 7). One of the remaining control lines is devoted to reading the status bit and must go low when a read operation is required (on a 6502 system it could be tied low permanently as the read and write are controlled by the same line). Of the remaining 6 control lines, one must be high and two must be low before anything happens. These would normally be used as select lines. The last three lines are used to select the operation to be carried out. One of these should be the R/W or similar function while the others will be simple address lines to select the particular operation to be performed. Exactly how these various lines are connected will depend on your particular requirements but Table 3 shows how we did it for a ZX81.

Construction

This should cause no headaches as it is quite

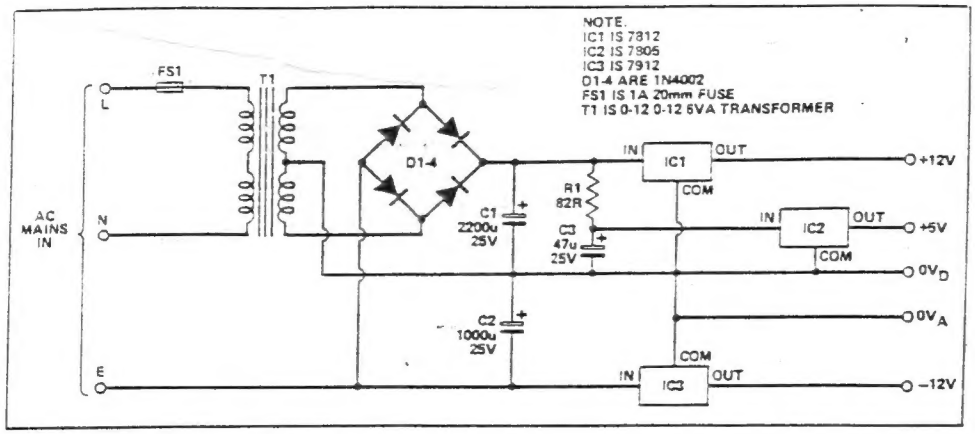


Fig. 3 Circuit diagram of the PSU.

straightforward. First of all, decide whether you want to use the PCB as it is or to split it into two parts (it might be tricky to cut it once the parts are assembled!). Note that there are eighteen links on the main board and five on the power supply, and begin by inserting these, the resistors, and the IC sockets. We recommend the use of sockets if only because some of the devices are expensive and therefore worth protecting... Next, fit the smaller capacitors, potentiometers, and sockets, followed by the power supply diodes, resistor R1 (mounted 6 mm above the board), larger capacitors, fuse, and power connector. Finally, fit the transformer and insert the ICs into their sockets. Check that the ICs and capacitors are mounted the right way round.

Test the power supply section fully before connecting it to the other board and BE CAREFUL, there is HIGH VOLTAGE present. If all is well, all that remains is to wire the PCB connectors to suit your microcomputer or whatever and then connect up.

Setting Up

If you have an oscilloscope at hand — you need one for the display — set up the sample driver program or something similar on your computer and check that you get negative going pulses on the outputs of IC7 pins 15, 14 and 11. (this could change if you use a different jumper pattern for a different computer interface.) Set VR1 to give a low pulse period of 400 us at pin 4 of IC8.

Check the outputs from IC13 with the oscilloscope. These should consist of straight line segments with no sudden jumps. If this is not the case, adjust VR2 and VR4 for the X channel and VR3 and VR5 for the Y channel. VR2 and VR4 are effectively offset controls which tend to have the effect of shifting the lines in one direction whereas VR3 and VR5 are gain controls which increase the slope of the lines in whichever direction they happen to be going. The proper setting of these controls is vital to the production of a good display. If you have difficulty setting them, set up the data in the display table to be 00,00,FF,FF etc. This will give a repeating full scale display.

When the controls have been set up reasonably, run the demonstration program and set the 'scope to X-Y mode. You should now have a moving display. Final trimming of the pots may be made to clear up any visible defects. If you do not have an oscilloscope, connect up the device to whatever you are using for a display, set all pots to mid travel and run the demo program and tweak for best results.

HOW IT WORKS

The Graf-vec consists of three major parts. The first of these is a straightforward stabilized power supply giving ± 12 V and +5 V at about 100 mA each. Only one transformer is used, to save on cost and space. The output is regulated by three IC stabilizers which often need no heatsink in normal operation. However, R1 is provided to dissipate some of the excess power in the +5 V regulator, and a small piece of aluminium would not go amiss.

The second major part consists of the logic, timing and digital to analogue conversion. IC7 is a 74LS138, 1 of 8 decoder whose inputs are available at the input connector. This enables simple interfacing to some computers systems without additional circuitry. The outputs from this device are all available on the board via links and are used to enable the other logic functions. The first output drives the strobe input of a 74LS374 (IC4), which is an octal latch with three-state outputs. The outputs from the device are permanently on in this circuit and it is used to store the data corresponding to the X vector before it is loaded into the DAC (IC5).

The next output from IC4 has two uses. It drives the data input enable pins on the DACs (IC5 & 6) and it also drives the trigger input on IC8. ICs 5 & 6 are ZN428 monolithic digital to analogue converters which accept data from the inputs when the enable pin is low and store it while the pin is high. They convert the digital data to a corresponding analogue output voltage in the range 0 to 2.55 V. Note that IC6 gets its data from the input data bus whereas IC5 gets it from the output of IC4.

IC8 is a dual monostable device only one part of which is used in this circuit. Its purpose is to provide the timing signals for the sweep generator, a display enable signal, and status indication back to the controller.

The next two outputs from IC7 are used to set or reset a simple latch made from two parts of IC10. An output from this latch is gated with the output from IC8 and enables or disables the display (if this facility is used.).

The final output from IC7 enables part of IC9 which is a 74LS125 quad three state buffer. This transfers the logic level at SK1 pin 19 onto the enable pin of another section of IC9. If this is low, the logic state of IC8 Q output is impressed on SK1 pin 20. This indicates that the unit is ready to start display when the pin is high.

The final part of the Graf-vec is made up of two identical circuits. Each of these takes the output from a DAC (IC5 or 6) and processes it to give the required output. We shall only explain one of these circuits as the other is exactly the same.

The output from the DAC comes via R6 and C7 which remove glitches and high frequency noise from the signal. It is then amplified by a factor of 2 by IC11a. This also provides a low impedence drive to the rest of the circuit.

Consider firstly the case when the Q output from IC8 is high (i.e. not triggered). The output from IC11a is connected via two of the four FET switches in IC12, an LF13331, to C9 and C11. This ensures that these capacitors are charged to a defined voltage before each sweep. Nothing further happens to this part of the circuit until the DACs are loaded with new information and IC8 is triggered. When this happens all the switches in IC12 are turned off. This isolates C9 which will hold its previous voltage for some time, and also removes the clamp on C11. The voltage on C9 is buffered by IC11b and applied via R13 to the inverting input of IC13. A new voltage now appears on the output of IC11a as the DAC has been updated. This is applied via R12 to the non-inverting input of IC13, an LM13600, which contains two transconductance amplifiers and two buffers. The transconductance amplifiers provide an output current which is proportional to the difference of the two input currents, modified by currents into two other inputs.

In this circuit, one amplifier and buffer combination is used for each channel. The currents through R12 and R13 are subtracted and a current proportional to their difference flows into C11. Currents flowing through R20 and VR4, R22 determine what the actual gain will be. As the voltage on IC11a output is constant after its initial change and that on IC11b output is also constant, the resulting current flowing into C11 will be constant. The result of this is that C11 will charge linearly and will also tend to go in the direction of the voltage on IC11a output. In fact, when everything is set up correctly, the voltage on C11 will just reach the voltage on IC11a output as the monostable pulse ends. At this time the capacitor voltage will be clamped by the FET switches being turned on again. The capacitor voltage is buffered by buffers in the LM13600 before being sent out.

Finally it should be mentioned that R16, 17 and VR2 form a balancing network and DC return path for the input currents and one of the control currents.

```
16514           11 10 00    LD DE,0010      :Scan counter = 256
   17 PICOUT    06 0E       LD B , 0E       :Points/scan = 14
   19           21 A0 40    LD HL,40A0      :Start of data table = 16544
   22 POINTOUT  7E          LD A,(HL)       : Get "X" data
   23           D3 1F       OUT (1F),A      :Output "X" data
   25           23          INC HL          :Move data pointer
   26 TESTIT    DB 1F       IN A,(1F)       :Input status indicator
   28           CB 7F       BIT A.7         :Isolate status bit
   30           28 FA       JRZ (TESTIT)    : Jump back if not ready (low)
   32           7E          LD A,(HL)       :Get "Y" data
   33           D3 3F       OUT (3F),A      :Output "Y" data
   35           23          INC HL          :Move data pointer
   36           10 F0       DJNZ (POINTOUT):Repeat for all points
   38           1B          DEC DE          :Decrement scan counter
   39           7A          LD A,D          :Get scan count high byte
   40           B3          OR A,E          :OR with scan count low byte
   41           20 E6       JRNZ (PICOUT)   : Repeat if not zero
   43           C9          RTS             :Return to calling program

DATA LIST
16544           00 80 40 C0 7F 80 AE C0
                FE 80 7F 80 97 68 7F 50
                68 68 7F 80 7F 3C 7F 80
                40 80 0C 00
```

Table 1. Z80 machine code demo program.

```
  10 REM ) ( ▞: S▀RNDACS ▀C IF .?▀
▗ NEW TAN XXXXXXXXXXXXXXXXXXXXXXX
XXXXXXX
  15 FAST
  17 LET X=10
  18 LET Y=X
  30 POKE 16545,X
  35 POKE 16553,X
  40 LET X=X+Y
  41 IF X>235 OR X<15 THEN LET Y
=(-1)*Y
  45 GOTO 20
  50 FOR K=16514 TO 16575
  60 PRINT K,
  70 INPUT A$
  75 IF A$="" THEN STOP
  80 IF LEN A$<>2 THEN GOTO 70
  90 LET A=CODE (A$(1 TO 1))
 100 LET B=CODE (A$(2 TO 2))
 110 LET C=CODE "F"
 120 LET D=CODE "0"
 130 IF A>C OR A<D OR B>C OR B<D
THEN GOTO 70
 140 POKE K,16*(A-D)+B-D
 150 PRINT CHR$ A;CHR$ B
 160 NEXT K
```

Table 2. ZX81 BASIC program. Note that you must go to line 50 to enter data and RUN to display.

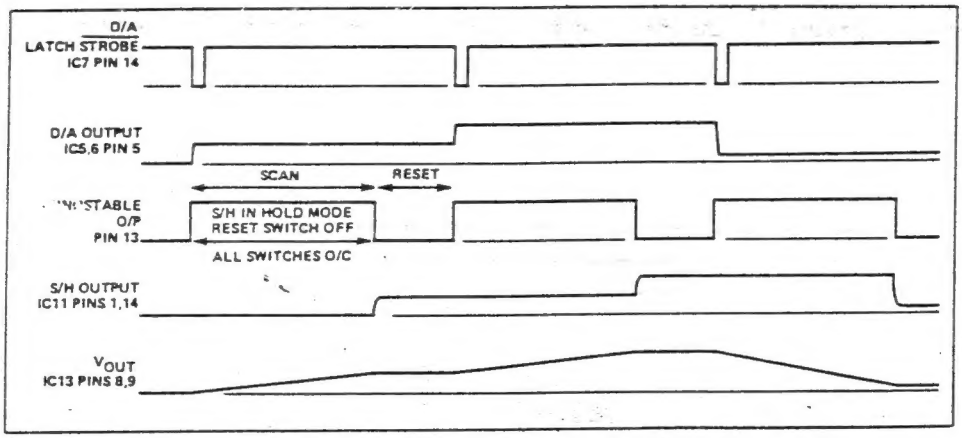


Fig. 4 Timing diagram of the Graf-vec.

Graf-vec, socket 1	ZX81
pins 1 - 8 (data in)	D0 - D7
pins 10, 17 (OV)	OV
pin 11 (address LSB)	A5
pin 12 (address)	A6
pin 13 (WRITE)	WR
pin 14 (SEL)	A7
pin 15 (SEL)	IORQ
pin 19 (READ)	RD
pin 20 (status out)	D7

Table 3 Connections to the ZX81.

PARTS LIST

Resistors (¼ W Carbon film unless otherwise stated)

R1	82R 1W
R2	100R
R3	390R
R4,16,17,18,19	470R
R5	22K
R6,7	2K2
R8,9,10,11	10K
R12,13,14,15, 20,21	12K
R22,23,24,25	18K
VR1,4,5	47K min. horizontal preset
VR2,3	470R min. horizontal preset

Capacitors

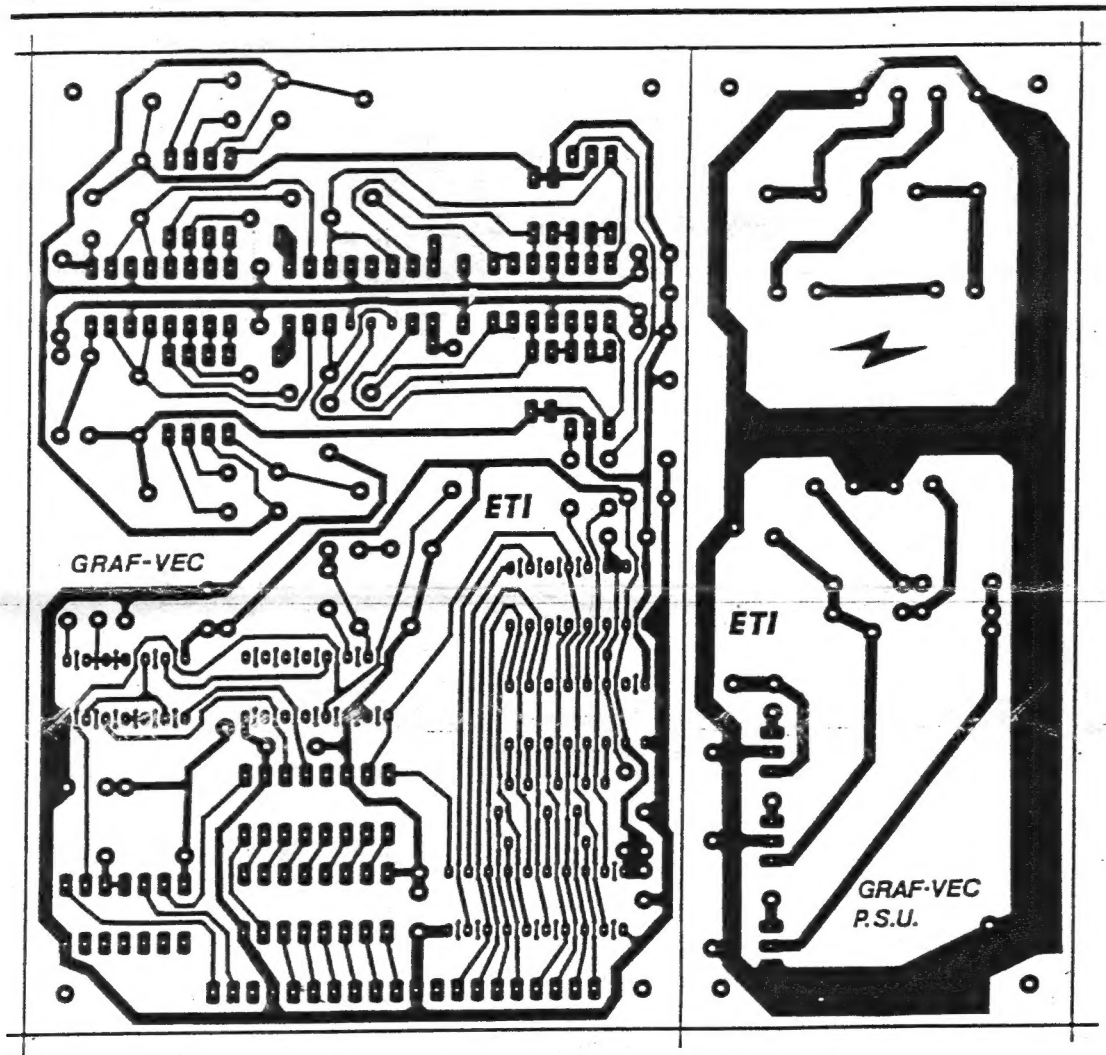
C1	2,200 uF 25 V axial electrolytic
C2	1,000 uF 25 V axial electrolytic
C3	47 uF 25 V axial electrolytic
C4,14,18,19,20	10uF 25 V tant. bead
C5,13	10nF ceramic disc
C6	22nF polycarbonate
C7,8	470 pF ceramic 1 nF polycarbonate
C11,12	10 nF polycarbonate
C15,16,17,21,22	100 nF ceramic

Semiconductors

IC1	1N4002
IC2	7805
IC3	7915
IC4	74LS374
IC5,6	ZN428
IC7	74LS138
IC8	74LS123
IC9	74LS125
IC10	74LS00
IC11	TL084
IC12	LF13331
IC13	LM13600
D1,2,3,4	1N4002

Miscellaneous

T1 0-12, 0-12 V 6 VA PCB mount transformer
FS1 1 A, 20 mm fuse + PCB mount holder
SK1 2 off, 10 way 0.1 in pitch PCB connector
PCB; Small heatsink for IC2; 23 way double sided edge connector 0.1 in pitch; 16 way(min) or 20 way ribbon cable.
(Ferrenti, distributed by Zentronics)



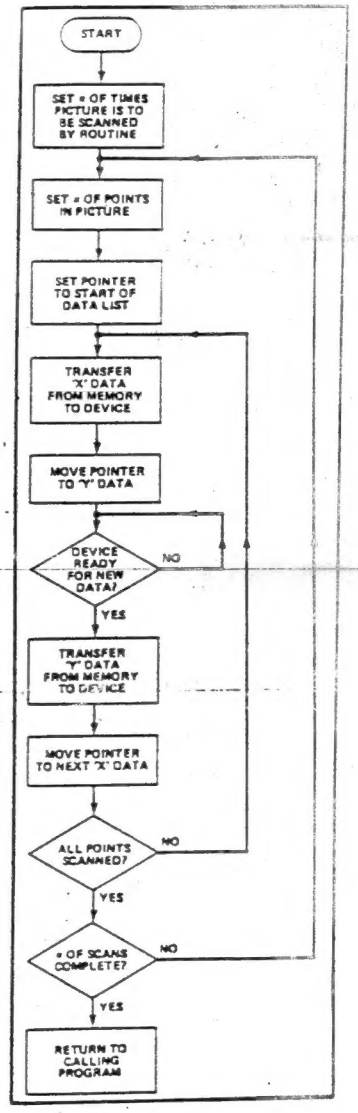


Fig. 6 The algorithm.

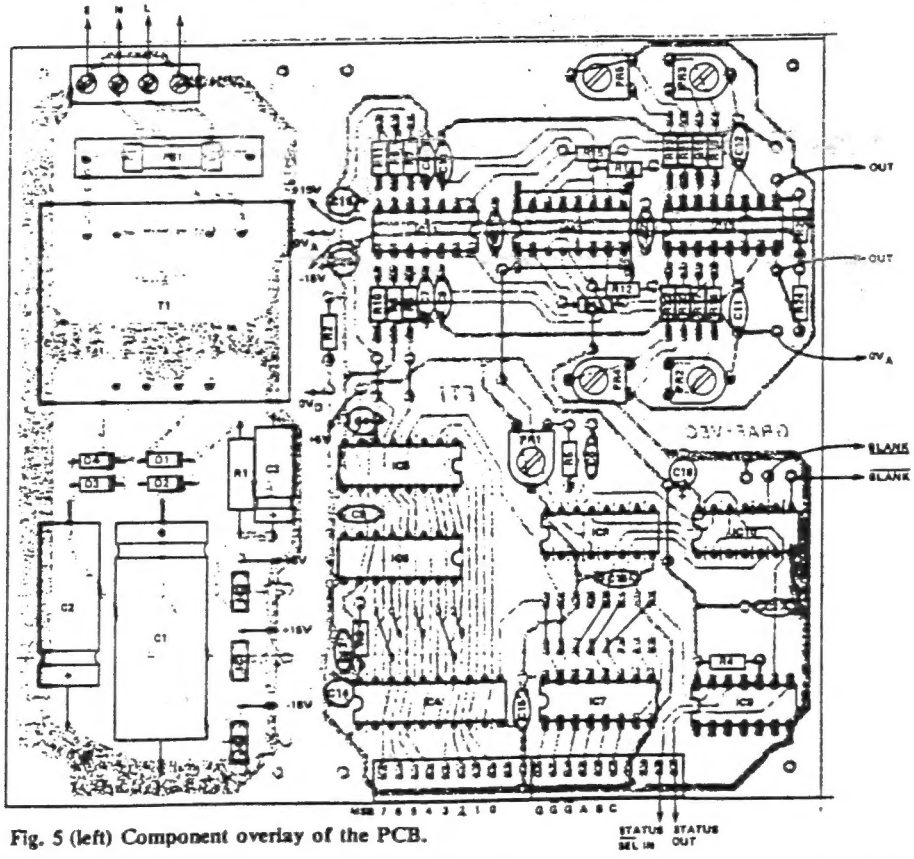


Fig. 5 (left) Component overlay of the PCB.

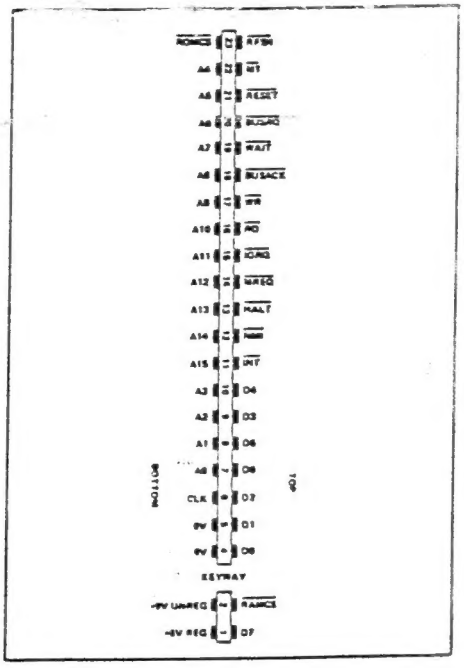
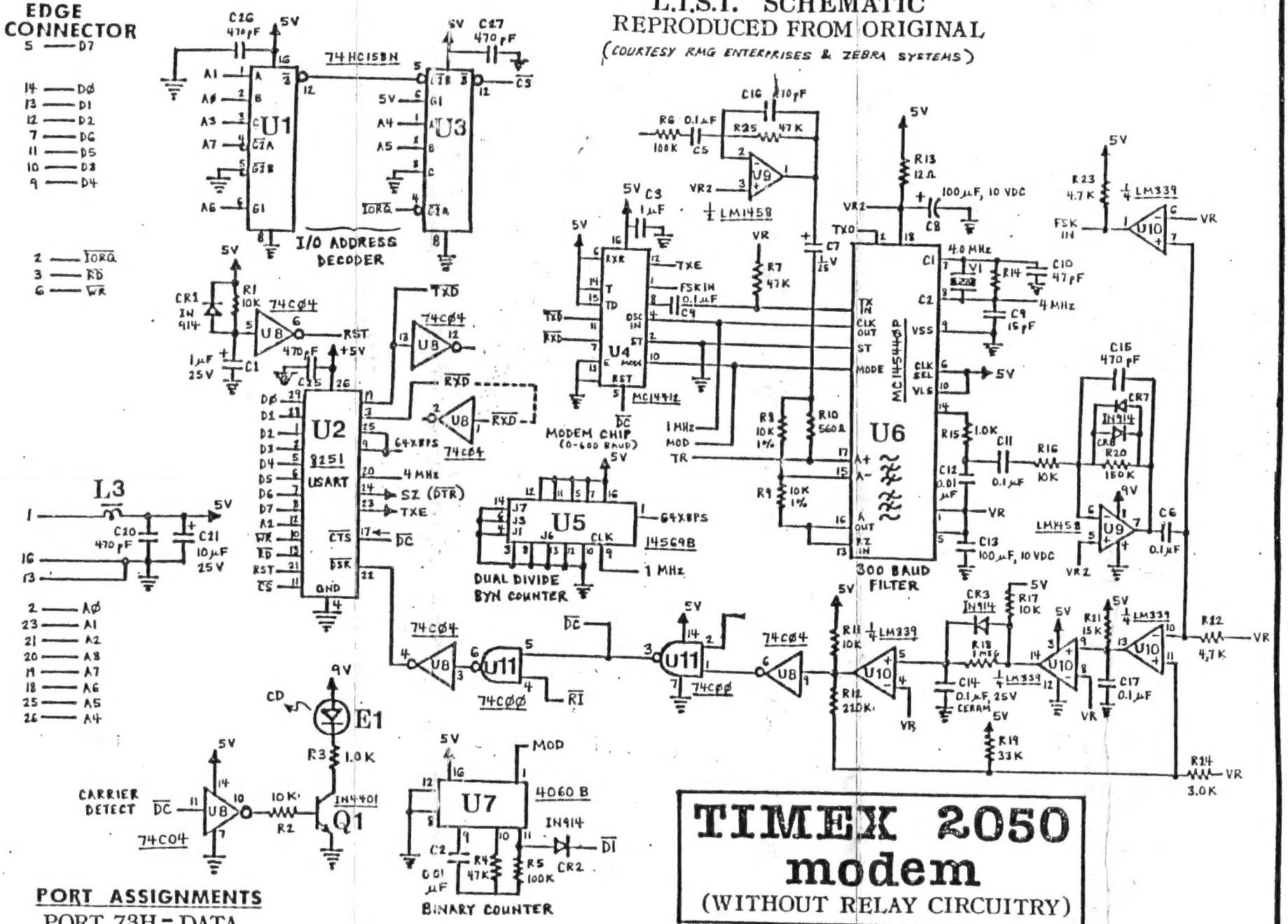


Fig. 7 The ZX81 edge connector.

L.I.S.T. SCHEMATIC
REPRODUCED FROM ORIGINAL
(COURTESY RMG ENTERPRISES & ZEBRA SYSTEMS)



PORT ASSIGNMENTS

PORT 73H = DATA
PORT 77H = CONTROL/STATUS

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Robert Gilder
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Robert Malloy
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USA postage $16.00
CANADA and MEXICO $17.50 US, and the rest of the world $24.00 US.

Bob Malloy, LIST Treasurer

WHO'S ONLINE

Some of us here at LIST have been wondering how many of our members are using modems with their Sinclair computers. It would be helpful if those of you who are into communications would take a few minutes to let us have the following info.

COMPUTER USED .....
COMMS PRGRM .....
BAUD RATE .....
EMAIL ADDRESS.....
ONLINE SERVICES USED.....
SUGGESTIONS FOR LIST.....

You can reply to me at either of the following addresses:
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